NOTES ON THE APPLICATION OF UPPER-AIR OBSERVATIONS TO WEATHER FORECASTING.

By Prof. ALFRED J. HENRY.

The wind movement across Mount Weather during May, 1912, as in the preceding month, was favorable for kite flying. On three days, however, no flight was possible, and on another day only a low altitude was attained. On three days the 5-kilometer (3-mile) level was reached, and on six other days the 4-kilometer (2.5-mile) level was reached and passed. The temperatures recorded in the upper levels reached by the kites were generally higher than were recorded for the corresponding levels in April, 1912, as might be expected, although a temperature of −19.9° Centigrade (−3.8° F.) was registered on the 17th at 5,034 meters (16,516 feet), thus indicating the presence of abnormally low temperature for the season and altitude. At the time of the flight Mount Weather was in the southwest quadrant of a depression centered over the St. Lawrence Valley. The low temperature aloft was attended by a west wind of 31 meters per second (70 miles per hour). The low temperature and high winds had no appreciable effect on surface conditions.

The speed of the wind from the surface up to the 5-kilometer (3-mile) level during May was considerably less than during the preceding month thus, from the surface up to the 2-kilometer (1.2-mile) level, there was a diminution in the May velocities as compared with April of 5.36 meters per second (12 miles per hour) in 25 cases; between the second and third kilometer levels the diminution in 9 cases was 5.81 meters per second (13 miles per hour); and between the third and fourth kilometer levels the diminution in 6 cases amounted to 7.15 meters per second (16 miles per hour). While, as a general rule, increase in wind velocity with increasing altitude is apparent, yet the exceptions are so numerous and the departures from any computed velocity made on the assumption of a constant increase in velocity with increase in altitude are so great that it does not seem possible as yet to lay down any safe rule as to the velocities to be expected at any certain altitudes. The pressure distribution at the earth's surface is perhaps the only means at our command of approximating the direction and speed of the wind aloft. The experience gained by the kite flights at Mount Weather indicates that surface pressure distribution affords a much better clue to the direction of the wind above than to its velocity. Unexpectedly high velocities were registered on May 2 and 31, when Mount Weather was in an anticyclonic region of weak surface pressure gradients and winds. Other cases of strong winds within the central area of a strong anticyclone have been recorded, where weak winds would be expected, so that those of the dates above mentioned are not isolated cases.

If the high winds aloft be grouped in a descending series as in the table following, it will be seen that relatively high winds may be encountered, not only in the higher levels, but also under 2 kilometers above sea level, as on the 2d and 8th.

High winds encountered above Mount Weather during May, 1912.

Velocity (miles per hour).	Direction.	Altitude above sea level (meters).	Date, May, 1912.
79	w-nw.	4,311	9
70	w.	5,034	17
68	w-nw.	4,509	2
68	w.	3,300	13
68	w-nw.	4,061	31
64	w.	4,586	19
57	w-nw.	2,067	2
57	n-nw.	1,846	8
57	n-nw.	3,600	10
57	sw.	4,261	11
57	w.	2,843	21
54	w-nw.	2,968	16
54	w-nw.	1,893	19

The average wind velocity during May at the time of the kite flights that attained altitudes between 1 and 2 kilometers was:

Surface, 18 miles per hour; aloft, 30 miles per hour—25 cases.

Between 2 and 3 kilometers: Surface, 18 miles per hour; aloft, 42 miles per hour—9 cases.

Between 3 and 4 kilometers: Surface, 20 miles per hour; aloft, 50 miles per hour—5 cases.

Between 4 and 5 kilometers: Surface, 18 miles per hour; aloft, 60 miles per hour—6 cases.

Above 5 kilometers and under 6 kilometers: Surface, 15 miles per hour; aloft, 56 miles per hour—3 cases.

The air was in unstable equilibrium on the 12th, 20th, 24th, and 30th. On the 12th, Mount Weather was in the eastern or front half of a cyclone, but the unstable condition was found in the upper portion of the flight only. On the 30th the unstable portion of the air column was found in the west or rear of a cyclone and only in the upper portion of the flight. On the 24th the air column up to the highest point reached, 3,700 meters above sea level, was in an unstable condition, the gradient being 1.31° C. per 100 meters. On this date the surface temperatures at Mount Weather were unusually high. On the last of the four dates named the unstable condition extended from the surface up to 1,867 meters above sea level, and was doubtless a result of local surface warming, and therefore the phenomenon can not have any value in weather forecasting.

In these notes for April, reference was made to the fact that a temperature gradient greater than the adiabatic for dry air was found in the air levels above the 1-kilometer level on days just previous to thunderstorms. The experience of the month just passed seems to indicate that the above-named condition is more than a chance coincidence; but further observations are needed to fully determine the nature of the temperature gradient in the free air just previous to the occurrence of thunderstorms.

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